

## Gallium Arsenide Semiconductor-Based Neutron Detector

Portable, Accurate Device Detects and Monitors Neutrons and Nuclear Materials

### APPLICATIONS

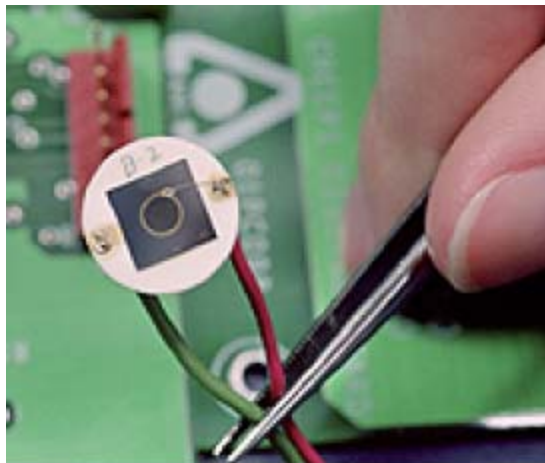
- Neutron detection
- Detecting and monitoring nuclear materials and weapons
- Permanent installations and portable field operation
- High-vacuum environments (e.g., physics labs and space platforms)

### BENEFITS

- More accurate and sensitive than other technologies
- Performance won't degrade over time
- Easy implementation and deployment
- Rugged, lightweight, and portable for field use
- Reduces false readings
- Requires less power
- Low mass-production cost (about \$1 per chip)

An advanced neutron detector developed by Argonne National Laboratory and Kansas State University accurately detects neutrons and finds concealed nuclear weapons and materials, even in harsh or challenging environments. The key component in the detector is a wafer of gallium arsenide ([GaAs](#)), a semiconducting material, coated with selected materials such as boron or lithium. When neutrons strike the coating, they produce a cascade of charged particles that is easy to detect. Conventional microchip processing techniques are used to fabricate it.

Argonne's rugged detector is more portable, compact, and less expensive than competing technologies. It provides positional information, directional dependence, gamma discrimination, radiation hardness, and spectral tailoring. In addition, the detector has much better spatial resolution than fission chambers, or other current detectors, and its timing is much faster than existing position-sensitive recording devices. The [GaAs](#) detector can be tailor-made for specific applications by varying the type and thickness of the coating, the contacts, and the semiconductor materials.



Researchers at Argonne successfully demonstrated prototype [GaAs](#) neutron detectors. The detectors are currently used as beam transmission monitors at Argonne's Intense Pulsed Neutron Source (IPNS). In this application, the detector provides real-time beam monitoring and allows an increase of 30% in useable beam time for instrument users. Plans include installing

additional detectors at the IPNS and at Oak Ridge National Laboratory's High Flux Isotope Reactor and Spallation Neutron Source. Several

## OVERVIEW: Argonne Homeland Security Technologies

### LINKS TO ONLINE INFORMATION

[GaAs fact sheet](#)

[Figaro fact sheet](#)

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integrated systems are currently under development for homeland security applications.

Argonne researchers continue making improvements in the characteristics, operation, and function of the detectors. Major efforts are under way to design integrated systems based on the [GaAs](#) technology, with the primary focus on detecting fissile materials, nuclear devices, and radiation sources for national security applications, including homeland defense, military applications, intelligence activities, and National Nuclear Security Administration initiatives.

An example of nuclear detection system which may employ the GaAs detector may be viewed at [FIGARO](#).

### ABOUT ARGONNE TECHNOLOGY TRANSFER

Argonne National Laboratory is committed to developing and transferring new technologies that meet industry's goals of improving energy efficiency, reducing wastes and pollution, lowering production costs, and improving productivity. Argonne's industrial research program, comprised of leading-edge materials research, cost-saving modeling, and unique testing and analysis facilities, is providing solutions to the challenges that face U.S. manufacturing and processing industries.

